

AV2, HV2, A2

3/4", 1", 1-1/8", 1-3/8" Bore

tom thumb®

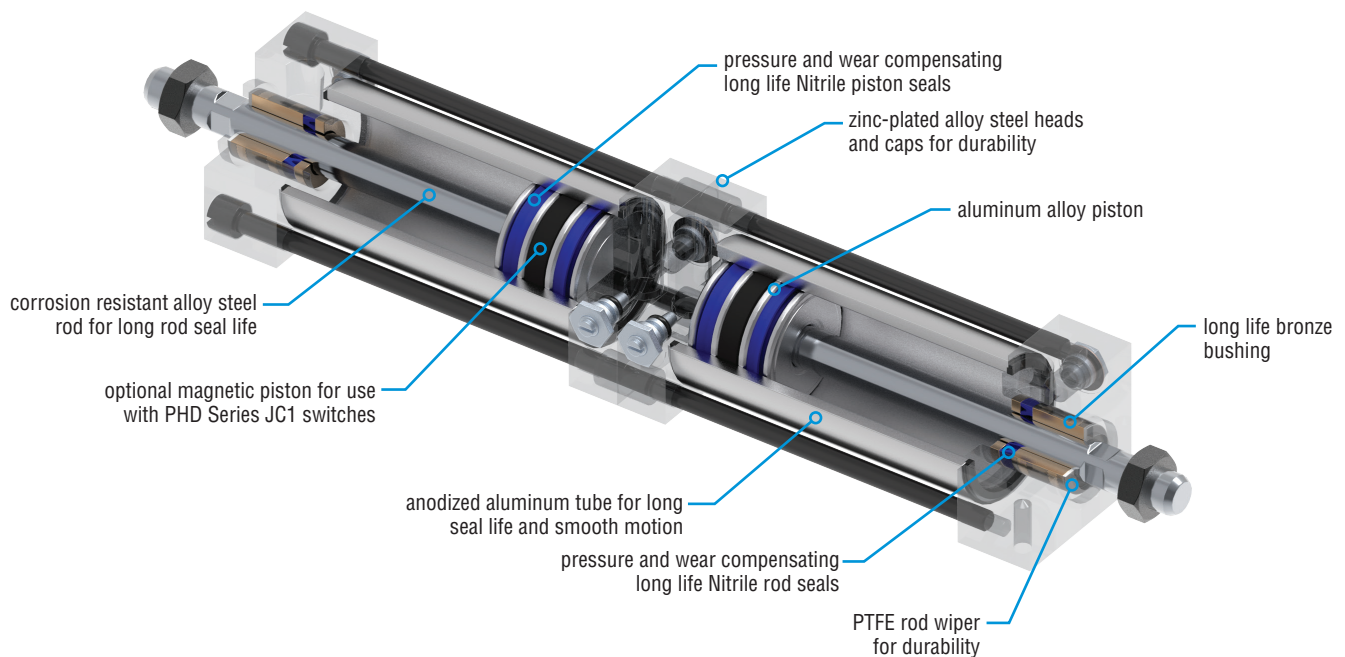
Major Benefits

- Four linear positions with double rod
- Long life design for low maintenance
- NFPA repairable for extended life providing long term savings
- Wide range of options for easy application and reduced design time
- Wide range of mounting styles for easy installation
- Simple four position operation

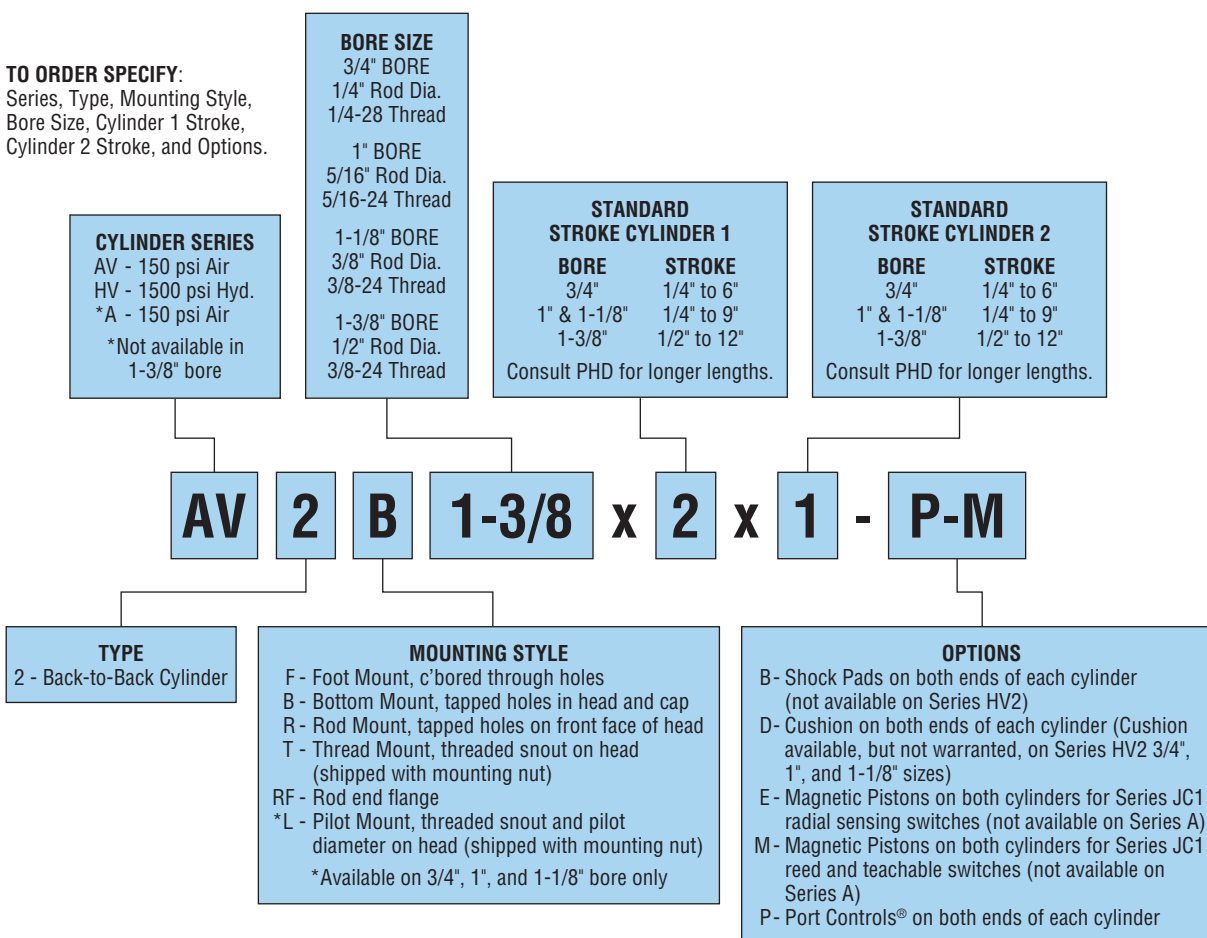


Series AV2

Cutaway depicts
a 1-1/8" bore AV2 unit.



TO ORDER SPECIFY:
Series, Type, Mounting Style,
Bore Size, Cylinder 1 Stroke,
Cylinder 2 Stroke, and Options.



Options may affect unit length. See dimensional pages and option information details.

SERIES JC1xDx MAGNETIC SWITCHES

PART NO.	DESCRIPTION
JC1RDU-5	PNP or NPN DC Reed, 5 meter cable
JC1RDU-K	PNP or NPN DC Reed, Quick Connect
JC1ADU-K	AC Reed, Quick Connect (M12)
JC1HDP-5	PNP (Source), Radial Sensing, 5 meter cable
JC1HDP-K	PNP (Source), Radial Sensing, Quick Connect
JC1HDN-5	NPN (Sink), Radial Sensing, 5 meter cable
JC1HDN-K	NPN (Sink), Radial Sensing, Quick Connect

NOTE: Switches must be ordered separately.

CORDSETS FOR SERIES JC1xDx SWITCHES

PART NO.	DESCRIPTION
63549-02	M8, 3 pin, Straight Female Connector, 2 meter cable
63549-05	M8, 3 pin, Straight Female Connector, 5 meter cable
81284-1-010	M12, 4 pin, Straight Female Connector, 2 meter cable

NOTE: Cordsets are ordered separately.

SERIES JC1ST TWO POSITION TEACHABLE MAGNETIC SWITCHES

PART NO.	DESCRIPTION
JC1STP-2	PNP (Source), Solid State, 12-30 VDC, 2 meter cable
JC1STP-K	PNP (Source), Solid State, 12-30 VDC, Quick Connect

NOTE: Switches must be ordered separately.

CORDSET FOR SERIES JC1ST SWITCHES

PART NO.	DESCRIPTION
81284-1-001	M8, 4 pin, Straight Female Connector, 5 meter cable

NOTE: Cordsets are ordered separately.

SWITCH MOUNTING BRACKET

CYLINDER SIZE	BRACKET NO.	DESCRIPTION
3/4"	92100	Mounts Series JC1 Switch to Tie Rod
1"		
1-1/8"		
1-3/8"	92101	

NOTE: Brackets are ordered separately.

SPECIFICATIONS	SERIES AV2	SERIES HV2	SERIES A2
OPERATING PRESSURE	20 to 150 psi air	40 to 1500 psi hyd*	20 to 150 psi air
OPERATING TEMPERATURE	-20° to +180°F [-29° to +82°C]	-20° to +180°F [-29° to +82°C]	-20° to +180°F [-29° to +82°C]
STROKE TOLERANCE	±0.032	±0.032	±0.032
LUBRICATION	Permanently lubricated	—	Permanently lubricated
MAINTENANCE	Field repairable	Field repairable	Field repairable

*Hydraulic rating is based on non-shock hydraulic service.

CYLINDER FORCE TABLE

SERIES	CYLINDER BORE	ROD DIAMETER	ROD DIRECTION	EFFECTIVE AREA FORCE lb/psi	AIR CONSUMPTION at 80 psi CUBIC ft/in OF STROKE*	DISPLACEMENT gal/in OF STROKE*
AV2 HV2 A2	3/4	1/4	EXTEND	0.442	0.0016	0.0019
			RETRACT	0.393	0.0014	0.0017
	1	5/16	EXTEND	0.785	0.0029	0.0034
			RETRACT	0.709	0.0026	0.0031
	1-1/8	3/8	EXTEND	0.994	0.0037	0.0043
			RETRACT	0.883	0.0032	0.0038
	1-3/8	1/2	EXTEND	1.485	0.0055	0.0064
			RETRACT	1.289	0.0048	0.0056

*Value per cylinder (Cyl 1 or Cyl 2). Total = 2X value.

MAXIMUM ALLOWABLE EXTEND STROKE

SERIES	ROD DIAMETER	CYLINDER FORCE (lb)							
		100	200	500	1000	1500	2000	3000	5000
3/4", 1", 1-1/8" AV2, HV2, A2	1/4	12"	9"	6"	4"	3"	—	—	—
	5/16	18"	13"	8"	6"	5"	—	—	—
	3/8	26"	18"	12"	9"	7"	—	—	—
1-3/8" AV2, HV2	1/2	48"	34"	21"	15"	12"	—	—	—

SERIES	CYLINDER BORE	UNIT WEIGHTS (lb)	
		ZERO STROKE	ADDER PER INCH OF STROKE*
AV2 PLAIN	3/4	0.84	0.04
	1	1.74	0.07
	1-1/8	1.90	0.10
	1-3/8	5.12	0.12

*Total Stroke = Stroke Cylinder 1 + Stroke Cylinder 2

CYLINDER FORCE CALCULATIONS

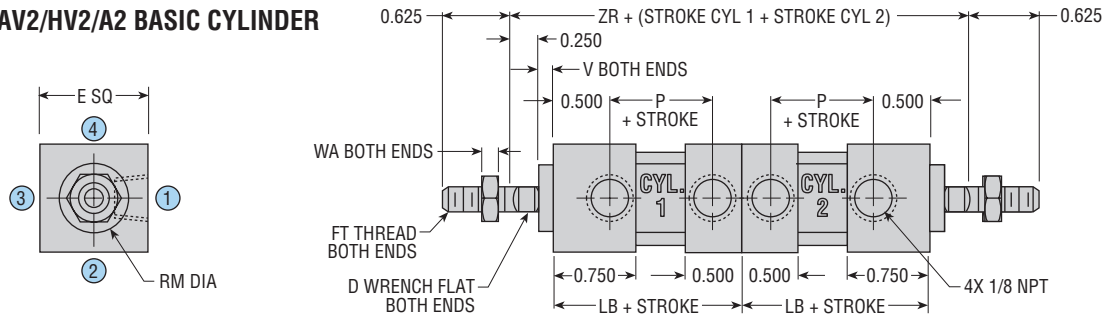
Imperial
F = P x A

F = Cylinder Force lbs
P = Operating Pressure psi
A = Effective Area in²
(Extend or Retract)

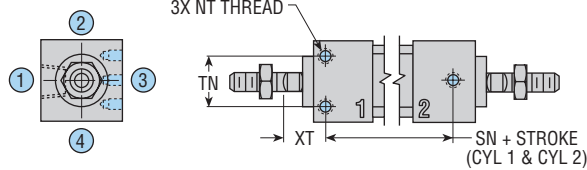
Application & Sizing Assistance

Use PHD's free online Product Sizing and Application at www.phdinc.com/apps/sizing

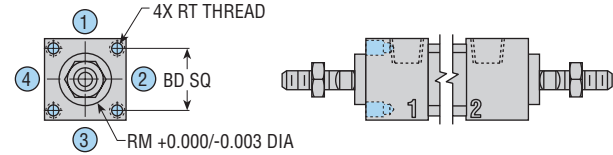
SERIES AV2/HV2/A2 BASIC CYLINDER



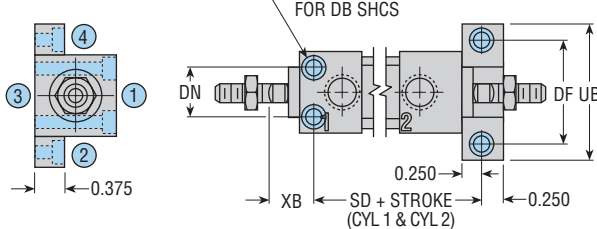
B (MS9)



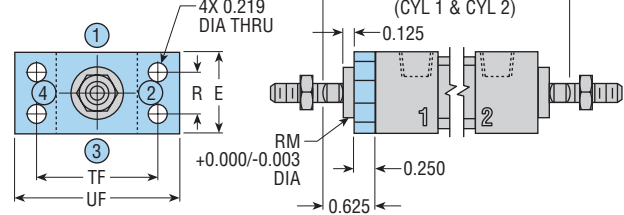
R (MR1)



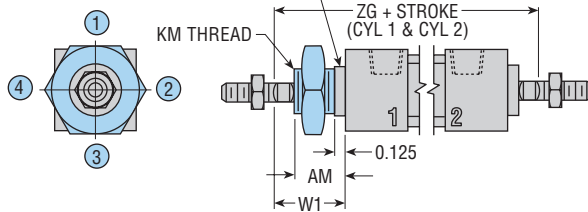
F (MS8)



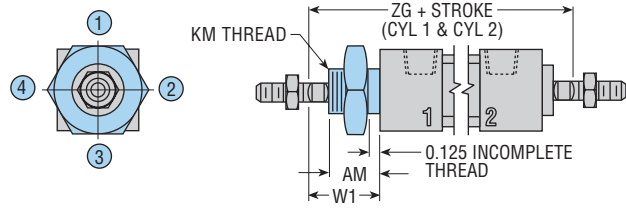
RF (MF1)



L (MNR1)



T (MN1)



All standard rod ends have four wrench flats (two wrench flats with "I" option).

DIMENSIONS COMMON TO ALL SERIES

BORE SIZE	LETTER DIMENSION															
	BD	D	DB	DF	DN	E	FT	NT	R	RM	RT	TF	TN	UB	UF	WA
3/4	0.750	3/16	#8	1.375	0.625	1.000	1/4-28	8-32 x 0.18 DP	0.500	0.625	8-32 x 0.25 DP	1.500	0.625	1.750	2.000	0.156
1	1.000	1/4	#10	1.750	0.875	1.375	5/16-24	10-32 x 0.25 DP	0.875	0.750	8-32 x 0.25 DP	1.875	0.875	2.125	2.375	0.188
1-1/8	1.125	5/16	#10	1.875	1.000	1.500	3/8-24	10-32 x 0.25 DP	1.000	0.750	10-32 x 0.25 DP	2.000	1.000	2.250	2.500	0.219

SERIES A2 CYLINDERS

BORE SIZE	LETTER DIMENSION															
	AM	KM	LB	P	RM1	SD	SN	V	W1	XB	XT	ZB	ZG	ZR		
3/4	0.625	5/8-18	1.750	1.000	0.687	3.562	3.062	0.125	0.875	0.562	0.562	4.500	4.750	4.250		
1	0.625	3/4-16	1.750	1.000	0.812	3.500	3.000	0.125	0.875	0.625	0.625	4.500	4.750	4.250		
1-1/8	0.625	3/4-16	1.750	1.000	0.812	3.500	3.000	0.125	0.875	0.625	0.625	4.500	4.750	4.250		

SERIES HV2 CYLINDERS

BORE SIZE	LETTER DIMENSION															
	AM	KM	LB	P	RM1	SD	SN	V	W1	XB	XT	ZB	ZG	ZR		
3/4	0.625	5/8-18	2.250	1.500	0.687	4.562	4.062	0.375	0.875	0.812	0.812	5.750	6.000	5.750		
1	0.625	3/4-16	2.250	1.500	0.812	4.500	4.000	0.375	0.875	0.875	0.875	5.750	6.000	5.750		
1-1/8	0.875	1-14	2.250	1.500	1.062	4.500	4.000	0.375	1.125	0.875	0.875	5.750	6.250	5.750		

SERIES AV2 CYLINDERS

BORE SIZE	LETTER DIMENSION															
	AM	KM	LB	P	RM1	SD	SN	V	W1	XB	XT	ZB	ZG	ZR		
3/4	0.625	5/8-18	2.250	1.500	0.687	4.562	4.062	0.125	0.875	0.562	0.562	5.500	5.750	5.250		
1	0.625	3/4-16	2.250	1.500	0.812	4.500	4.000	0.125	0.875	0.625	0.625	5.500	5.750	5.250		
1-1/8	0.875	1-14	2.250	1.500	1.062	4.500	4.000	0.125	1.125	0.625	0.625	5.500	6.000	5.250		

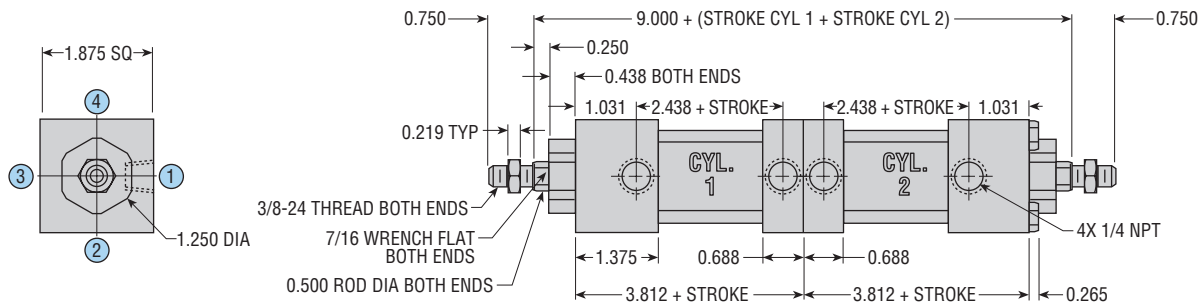
PORT POSITIONS: INDICATED BY CIRCLED NUMBERS

CUSHIONS: ADD 1.000 in TO ALL (+ STROKE) DIMENSIONS OF CYLINDER 1 AND CYLINDER 2 (2" TOTAL TO OVERALL)

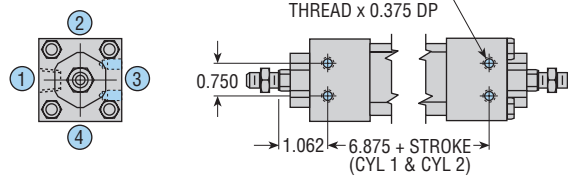
SHOCK PADS: ADD 0.500 in TO ALL (+ STROKE) DIMENSIONS OF CYLINDER 1 AND CYLINDER 2 (1" TOTAL TO OVERALL)

All dimensions are reference only unless specifically toleranced.

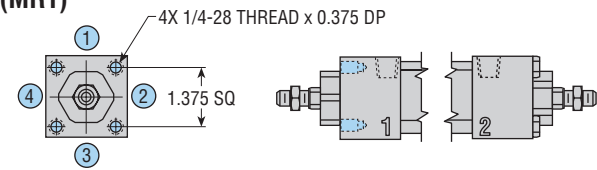
SERIES AV2/HV2 BASIC CYLINDER



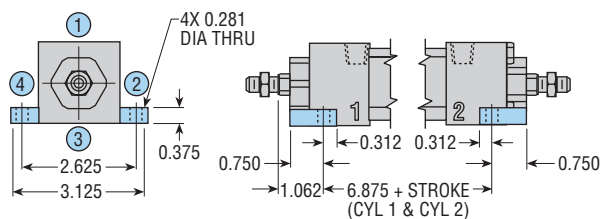
B (MS4)



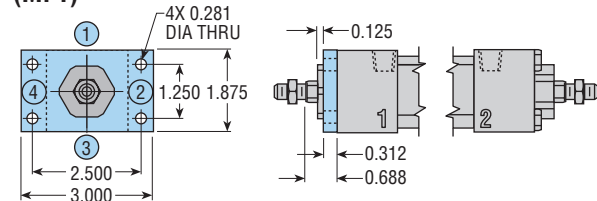
R (MR1)



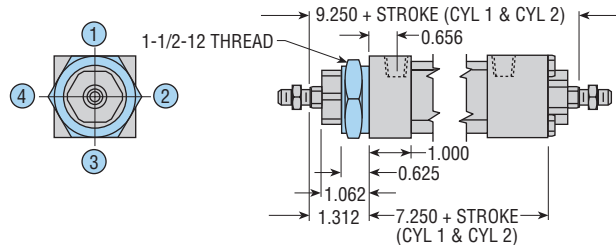
F (MS2)



RF (MF1)



T (MN1)



All standard rod ends have four wrench flats (two wrench flats with "I" option).

PORT POSITIONS: INDICATED BY CIRCLED NUMBERS

CUSHIONS: CYLINDER LENGTH IS NOT AFFECTED BY ADDITION OF CUSHIONS

SHOCK PADS: ADD 0.500 in TO ALL (+ STROKE) DIMENSIONS OF CYLINDER 1 AND CYLINDER 2 (1" TOTAL TO OVERALL)

All dimensions are reference only unless specifically toleranced.

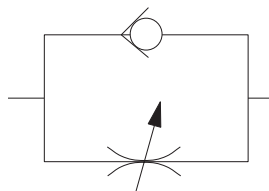
P

PORT CONTROL®

The exclusive PHD Port Control®, based on the “meter-out” principle, features an adjustable needle and a separate ball check. Both are built into the cylinder end cap and are used to control the speed of the cylinder over its entire stroke.

The self-locking needle has micrometer threads and is adjustable under pressure. It determines the orifice size which controls the exhaust volume. The separate ball check is closed while fluid

is exhausting from the cylinder, but opens to permit full flow of incoming fluids. The PHD Port Control® provides the optimum in speed control for small bore cylinders. It saves space and eliminates the cost of installation and fittings for external flow control valves.



D

ADJUSTABLE CUSHION

PHD Cushions are designed for smooth deceleration at the end of stroke. When the cushion is activated the remaining volume in the cylinder must exhaust past an adjustable needle which controls the amount of deceleration.

See dimension pages for dimensional information.

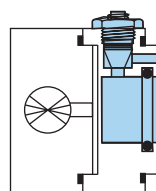
3/4", 1", 1-1/8" Series A2, A2V, H2V = Cushion Block

1-3/8" Series A2V, H2V = Poppet Style

Effective cushion length 1/2"

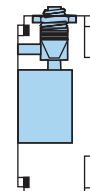
Not warranted on Series HV2 3/4", 1", 1-1/8" units

CUSHION BLOCK



3/4", 1", 1-1/8" BORE

POPPET STYLE

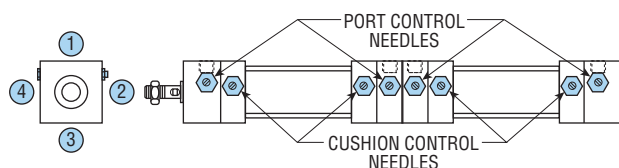


1-3/8" BORE

STANDARD PORT CONTROL® & CUSHION NEEDLE POSITIONS

(3/4", 1", 1-1/8" Bore Series A2, AV2, and HV2 Cylinders)

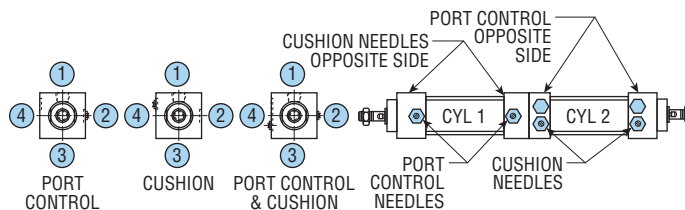
Port Control® and cushion needles are located in position 2 on standard cylinders. They may be located at position 4 when specified on all Series A2, AV2, and HV2. Consult PHD for special Port Control® or cushion needle positions.



STANDARD PORT CONTROL® & CUSHION NEEDLE POSITIONS

(1-3/8" Bore Series AV and HV Cylinders)

Port Control® and cushion needles are located on opposite sides adjacent to port. Please consult distributor or PHD to check availability of special Port Control® or cushion needle positions.

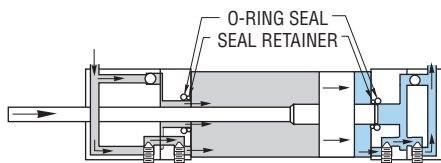


PORT CONTROL® AND ADJUSTABLE CUSHION COMBINATION

(3/4", 1", 1-1/8" Bore Series A2, AV2, and HV2 Cylinders)

Cushion and Port Control® combination arranged in series provides a compact efficient control system for maximum space weight and cost savings. The cushion is activated when the piston extension enters a seal in the cushion block. The remaining volume in the cylinder exhausts past an adjustable needle. A check seal in the adjusting needle is closed during deceleration, but opens to permit full flow for immediate reversing. The cushion seal in the block is an o-ring for air units.

CUSHION BLOCK STYLE

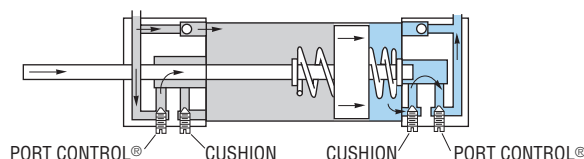


PORT CONTROL® AND ADJUSTABLE CUSHION COMBINATION

(1-3/8" Bore Series AV2 and HV2 Cylinders)

The cushion and Port Control® combination is also available on the 1-3/8" Bore. This cushion is activated when a seal, which is traveling with the piston, seals against the cylinder end cap. This causes the remaining volume in the cylinder to exhaust past an adjustable needle which controls the amount of deceleration. The spring, which extends the seal from the piston, permits the seal to act as a check valve to allow full flow back into the cylinder for immediate reversing. The cushion seal for air units is made of urethane while seals for oil units are close tolerance metal.

POPPET STYLE



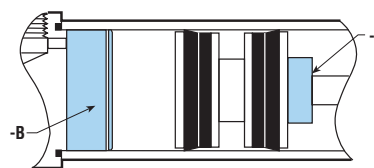
B

SHOCK PADS

Polyurethane pads for absorption of shock and noise (not available on hydraulic units). Reducing shock permits higher piston velocities for shorter cycle times. Reducing noise levels provides improved environment for increased productivity. Eliminates metal to metal contact between piston and end caps.

Available together with all options EXCEPT:

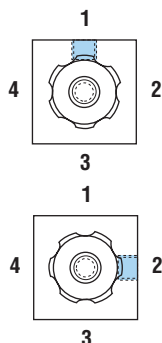
- Same end as Cushion (-D)



PORT POSITIONS

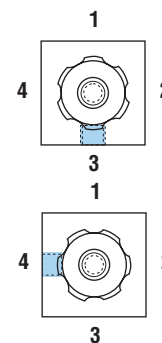
Port position 1 is standard on all cylinders.

PORT POSITION 1 (STANDARD)



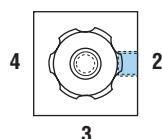
T

PORT POSITION 3



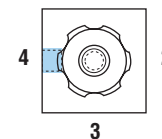
R

PORT POSITION 2



U

PORT POSITION 4



E

MAGNETIC PISTON FOR SERIES JC1 RADIAL SENSING SWITCHES

PHD Cylinders can include a magnetic band (-E) on the piston to trigger external radial sensing solid state switches. These switches enable Tom Thumb® air or hydraulic cylinders to connect with different logic systems and work with the switches listed below.

See Series JC1 Switches at phdinc.com for more information.

M

MAGNETIC PISTON FOR SERIES JC1 REED & TEACHABLE SWITCHES

A magnetic band (-M) on the piston triggers externally mounted PHD Reed Switches and Two Position Teachable Switches. Reed switches use a physical element to close the circuit, whereas solid-state switches utilize magnetoresistive principles.

The Teachable Switch enables two programmable positions with one device – no fine tuning needed. Simply align the switch, position the actuator, and program the two positions.

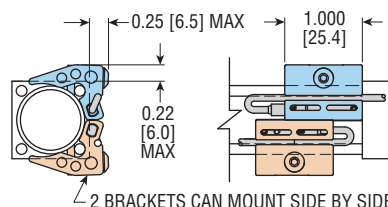
SERIES JC1 MAGNETIC SWITCHES AND CORDSETS

MAGNET OPTION	SENSING TYPE	OUTPUT / VOLTAGE	CABLE	SWITCH PART NO.	CORDSETS	
					2 METER	5 METER
-E [Radial]	Solid State	NPN / DC	5 m, 3 Conductor	JC1HDN-5	—	—
			.3 m, M8 3-Pin	JC1HDN-K	63549-02	63549-05
		PNP / DC	5 m, 3 Conductor	JC1HDP-5	—	—
			.3 m, M8 3-Pin	JC1HDP-K	63549-02	63549-05
-M [Axial]	Reed	PNP or NPN / AC	.3 m, M12 4-Pin	JC1ADU-K	81284-1-010	—
			5 m, 3 Conductor	JC1RDU-5	—	—
		PNP or NPN / DC	.3 m, M8 3-Pin	JC1RDU-K	63549-02	63549-05
			2 m, 4 Conductor	JC1STP-2	—	—
	Solid State	PNP / DC	2 m, M8 4-Pin	JC1STP-K	—	81284-1-001

SWITCH MOUNTING BRACKET

CYLINDER SIZE	BRACKET NO.
3/4	92100
1	
1-1/8	
1-3/8	92101

NOTE: Brackets are ordered separately.



V

FLUOROELASTOMER SEALS

Fluoroelastomer seals are available to achieve seal compatibility with certain fluids. Seal compatibility should be checked with the

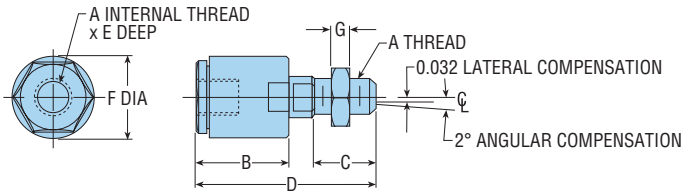
fluid manufacturer for proper application. Consult PHD for high temperature use.

All dimensions are reference only unless specifically toleranced.

SELF-ALIGNING PISTON ROD COUPLERS

Rod Couplers eliminate expensive precision machining for mounting fixed or rigid cylinder on guide or slide applications.

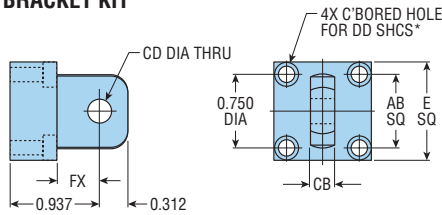
Cylinder efficiency is increased by eliminating friction caused by misalignment. Couplers compensate for 2° angular error and 1/32" lateral misalignment on push and pull stroke.



MODEL NO.	LETTER DIMENSION						
	A	B	C	D	E	F	G
250	1/4-28	1.000	0.625	1.875	0.500	0.875	0.156
312	5/16-24	1.000	0.625	1.875	0.500	0.875	0.187
375	3/8-24	1.000	0.625	1.875	0.500	0.875	0.219
437	7/16-20	1.125	0.650	2.187	0.500	1.000	0.250

To order, specify the model number.

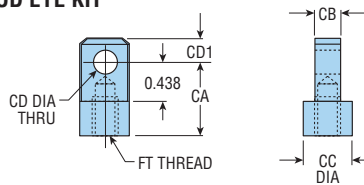
EYE BRACKET KIT



BORE SIZE	CYLINDER SERIES	PART NO.	LETTER DIMENSION					
			AB	CB	CD	DD*	E	FX
3/4	A2, AV2, HV2	1077-01	0.750	0.248	0.250	#6	1.000	0.577
1 &	A2	1077-02	1.000	0.373	0.250	#10	1.375	0.437
1-1/8	AV2, HV2	1077-03	1.000	0.373	0.375	#10	1.375	0.437

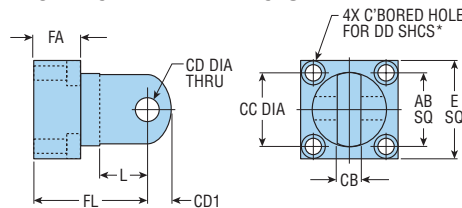
*For 3/4 bore thru hole only.

ROD EYE KIT



BORE SIZE	CYLINDER SERIES	PART NO.	LETTER DIMENSION						
			CA	CB	CC	CD	CD1	FT	
3/4	A2, AV2	1075-01	0.750	0.248	0.500	0.250	0.250	1/4-28 x 0.375 DP	
1	A2	1075-02	0.875	0.373	0.750	0.250	0.375	5/16-24 x 0.375 DP	
	AV2	1075-04	0.875	0.373	0.750	0.375	0.375	5/16-24 x 0.375 DP	
1-1/8	A2	1075-03	0.875	0.373	0.750	0.250	0.375	3/8-24 x 0.312 DP	
	AV2	1075-05	0.875	0.373	0.750	0.375	0.375	3/8-24 x 0.312 DP	

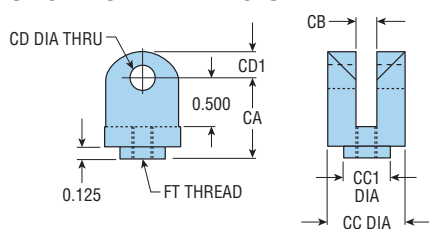
CLEVIS BRACKET KIT - PIN INCLUDED



BORE SIZE	CYLINDER SERIES	PART NO.	LETTER DIMENSION									
			AB	CB	CC	CD	CD1	DD*	E	FA	FL	L
3/4	A2, AV2	12901	0.750	0.254	0.750	0.250	0.250	#6	1.000	0.360	1.187	0.500
1 &	A2	12902	1.000	0.379	0.875	0.250	0.375	#10	1.375	0.500	1.250	0.531
1-1/8	AV2	12903	1.000	0.379	0.875	0.375	0.375	#10	1.375	0.500	1.250	0.531

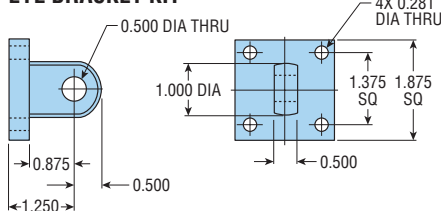
*For 3/4 bore thru hole only.

ROD CLEVIS KIT - PIN INCLUDED



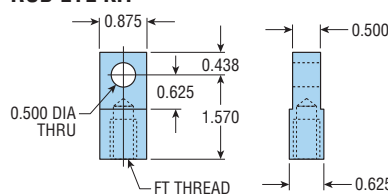
BORE SIZE	CYLINDER SERIES	PART NO.	LETTER DIMENSION						
			CA	CB	CC	CC1	CD	CD1	FT
3/4	A2, AV2	12904	0.812	0.254	0.750	0.437	0.250	0.250	1/4-28 TO SLOT
1	A2	12905	0.875	0.379	0.875	0.562	0.250	0.375	5/16-24 TO SLOT
	AV2	12906	0.875	0.379	0.875	0.562	0.375	0.375	5/16-24 TO SLOT
1-1/8	A2	12907	0.875	0.379	0.875	0.562	0.250	0.375	3/8-24 TO SLOT
	AV2	12908	0.875	0.379	0.875	0.562	0.375	0.375	3/8-24 TO SLOT

EYE BRACKET KIT



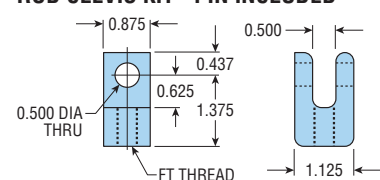
BORE SIZE	CYLINDER SERIES	PART NO.
1-3/8	AV2, HV2	1330

ROD EYE KIT



BORE SIZE	CYLINDER SERIES	PART NO.	LETTER DIMENSION
1-3/8	AV2, HV2	1375-01	3/8-24 x 0.750 DP

ROD CLEVIS KIT - PIN INCLUDED



BORE SIZE	CYLINDER SERIES	PART NO.	LETTER DIMENSION
1-3/8	AV2, HV2	12909	3/8-24 TO SLOT

All dimensions are reference only unless specifically tolerated.